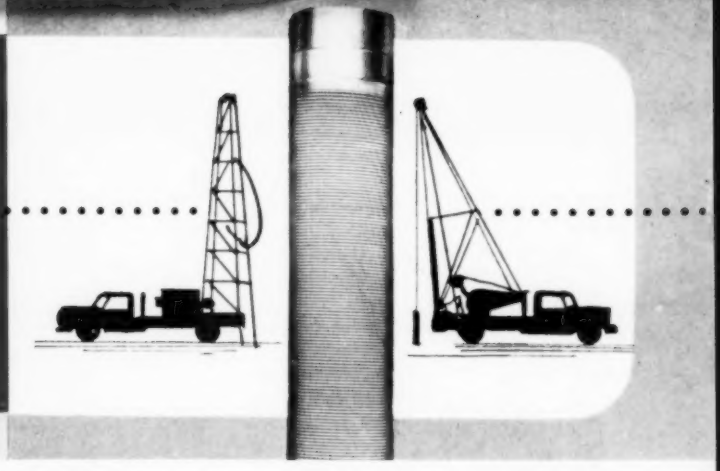
The Johnson National DRILLERS JOURNAL



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REASONS SOME WELLS ARE DISAPPOINTMENTS

The Problem of Sand-Pumping

In the previous article under this title, we started a discussion of the problem of sand-pumping. Three cases of sand-pumping wells were described. The high cost of pump repair and the penalty of short life of such wells were pointed out. These experiences give a good idea of the extra costs that are the results of improper well-design and construction.

In one case, in Washington, a gravel-packed well which pumped a lot of sand was replaced with a naturally-developed well that is not only sand-free but pumps more water than the old well. A second case was a California well completed with slotted pipe. The pump became sand-locked in this well and the slotted casing collapsed. A gravel-packed well was then put in, using slotted pipe, and it pumped sand too. Three pump-bowl assemblies were worn out by the sand in less than two years.

The third situation described is the widespread difficulty that is found in the High Plains area of Texas where slotted pipe is used generally to complete wells in the water-bearing sands of the "Ogallala formation." From the study of many wells in that area, it is our opinion that the slotted pipe contributes little or nothing toward preventing sand-pumping and that sand-free wells are obtained only when there is sufficient cementing material in the water-bearing sand to hold the sand in place in the formation. The degree of cementation varies greatly, so when drilling a slotted-pipe well in that area you never know in advance whether or not a lot of sand will come with the water when pumping is started. It is largely a hit-or-miss proposition.

Gravel-packing of wells has been tried in many instances in the High Plains area to overcome sand-pumping. In most cases the gravel-packing has not solved the problem, largely because some of the basic principles of properly gravel-packing the wells have been overlooked. We are going to describe one job in detail to illustrate why improperly-designed, gravel-packed wells pump sand; and to indicate the fundamentals of correct design and construction.

Artificial gravel treatment or gravel-packing of wells is needed only in those cases where the natural formations contain no coarse material at all. Where some coarse sand or fine gravel is present, mixed with the finer sand, naturally-developing an envelope of the coarser particles around the well screen is preferable to artificial gravel-packing. However, artificial gravel-packing has its place, and the purpose here is to show the principles to be followed and the steps to be taken to get good results.

Success with any type of well or any phase of well construction depends largely upon the well driller having the right understanding of the situation and having the willingness to go through the required steps to produce the best end-result. The majority of successful well drillers know how important these two factors are. All drillers should keep them in mind, always.

In designing and constructing gravel-packed wells the most common mistake stems from looking at the well problem "in reverse." Take, for example, the job where the perforated pipe shown in Figure 1 was used. It is shown here being installed in a well drilled in a fine-sand formation. Gravel was later poured in the hole around this perforated pipe. Note the size of the perforations, which are at least $\frac{3}{8}$-inch wide. The gravel put in around this slotted pipe must necessarily be $\frac{3}{8}$-inch material and larger. Any smaller gravel would simply come through the perforations into the well. The size of the perforations, in this case, immediately demands that the gravel-packing be fairly coarse gravel. The same size gravel would have to be used whether the well was drilled in fine sand or coarse gravel, for the width of the slots fixes the minimum size of gravel-pack material that can be used.

But, will $\frac{3}{8}$-inch to $\frac{3}{4}$-inch gravel control the fine sand of the water-bearing formation when the well is pumped? In considering this question, after the width of casing slots and size of gravel are already set, we begin to see the error in setting up the design of a gravel-packed well "backwards."

The reason for gravel-packing a well is to control the sand of the

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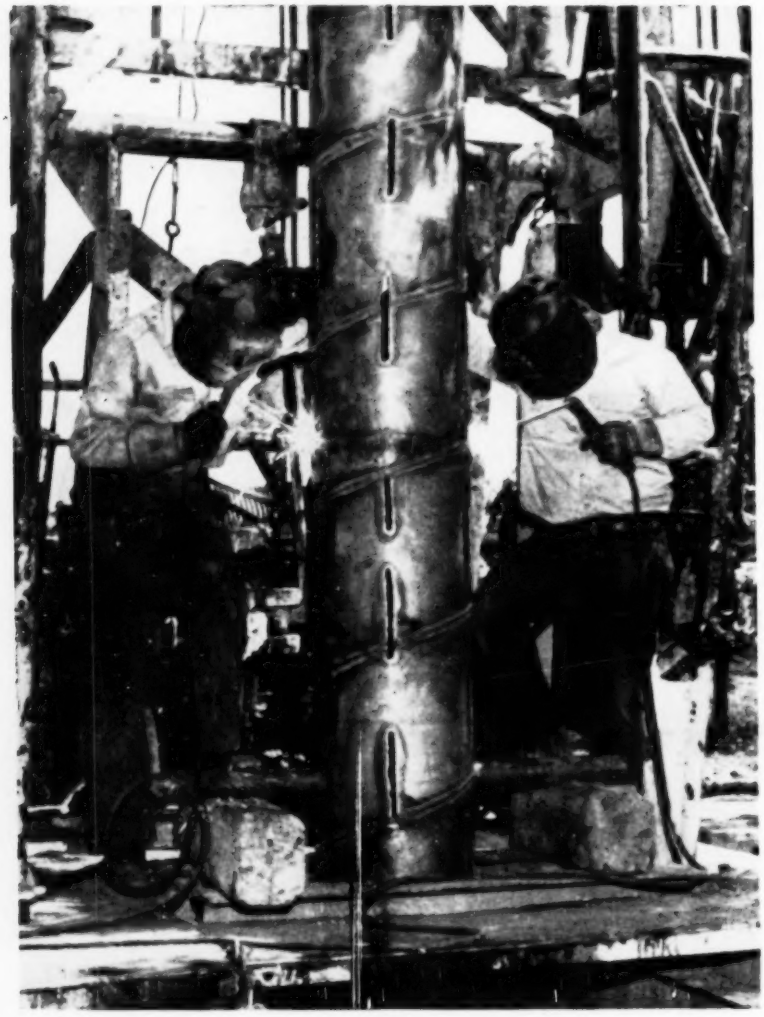

Figure 1. Sections of torch-perforated pipe being welded together during installation in gravel-packed irrigation well. Slots are about ⅜-inch by 8-inches.

water-bearing formation. The gravel envelope should prevent sand-pumping, and at the same time allow water to flow freely through it and into the well. In designing the well, then, why not start with the size of the sand particles in the formation instead of the size of the casing perforations? Why select the gravel on the basis of the width of the casing perforations instead of definitely relating the grading of the gravel to that of the formation sand that the gravel must control?

Irrigation Wells in Texas

Some pictures of material from an actual job will show more clearly the results of choosing and using the wrong grading of gravel. Figure 2 shows, in actual size, a sample of the water-bearing sand encountered in drilling several irrigation wells in Deaf Smith County, Texas. Sand of this character is typical of the water-bearing formation in that general area. Some five years ago, a well driller was engaged to drill several irrigation wells on a large ranch in the southern part of the county. The first two wells were drilled a little over 350 feet deep and completed with torch-slotted pipe, without gravel-packing. One of these pumped so much sand during test-pumping that it was impossible to use the well and was abandoned at once. The second one pumped less sand and was usable, although pump wear was excessive.

Pump removal, repair and re-setting is a costly operation in this area because of the deep settings required. The static water level is at 200 to 250 feet, which means that pump bowls must be at least 300 feet below ground surface in the better wells and even deeper in the less efficient ones.

In an effort to obtain better results, the owner and the well driller decided to see what gravel-packing might do to help solve their problem. Neither had any experience in doing this and they did not know of anyone who could give them the proper advice. They knew the popular ideas about gravel-packing which we have already described as being the "reverse" approach to the design. They considered the width of the slots in the torch-perforated pipe that was available—then selected gravel that was coarser than these slots. The fact that this gravel might not control the sand of the water-bearing formation any better than the slotted pipe alone was not apparent to them. As so many people do, they assumed that just the idea of gravel-packing in a large diameter hole would do the trick.

Figure 3 shows the actual size of gravel that was selected to use in the next two wells. Comparison of this material with the formation sand in Figure 2 shows the obvious fact that all of the sand will pass through the voids or openings between gravel particles. Later, in laboratory tests, we found that the average size of the openings between the gravel particles was more than nine times the size of the largest grains of sand.

Each of these wells was drilled by the rotary method, 30 inches in diameter and about 360 feet deep. Sixteen-inch slotted pipe was centered in the open hole and gravel was dumped in. A test pump was installed to "develop" the well and remove the sand that might be brought in by the pumping and surging. It was hoped, of course, that little sand would come through. This hope turned to dismay when

pumping was started, for large quantities of sand came along with the water in each case.

The gravel moved down rapidly to occupy the space left by the sand that was pumped out. More gravel was added to keep the level up above the top of the perforated section. As each well took more and more gravel, it was felt that surely the sand would stop as soon as the diameter of the "gravel-pack" became large enough. However, after putting some 500 tons of gravel in the two wells at a cost of almost $2,000 for material alone, both were still sand-pumpers. The wells were usable for irrigation, but the owner was still saddled with the cost of frequent pump repair.

After this experience, the well driller heard that our engineering department had done experimental work and research on the screening of fine-sand formations and on the design of gravel-packed wells. He came to St. Paul and related the details of the four wells he had drilled about as we have given them here. He brought along, for testing, the sand shown in Figure 2 and the gravel of Figure 3. The moment that it was shown to him that the openings in the gravel were much too large to control the formation sand, he saw the fallacy of improper gravel-pack design.

Based upon our own findings of the proper relationship between the grading of the formation sand and the grading of the gravel to control the sand, we recommended a gravel material to be used in the fifth well to be drilled. The recommended material ranged in particle size from less than 1/16-inch to about $^1/_8$-inch grains. This was more like a coarse filter sand than a gravel, but was the kind of material required for controlling the sand that the driller had to deal with. The driller protested that such material would not let enough water through, until he was shown that the permeability of the particular material recommended was more than 100 times the permeability of the sand formation itself. In other words, water would flow through the recommended gravel treatment 100 times more freely than it would through the natural formation.

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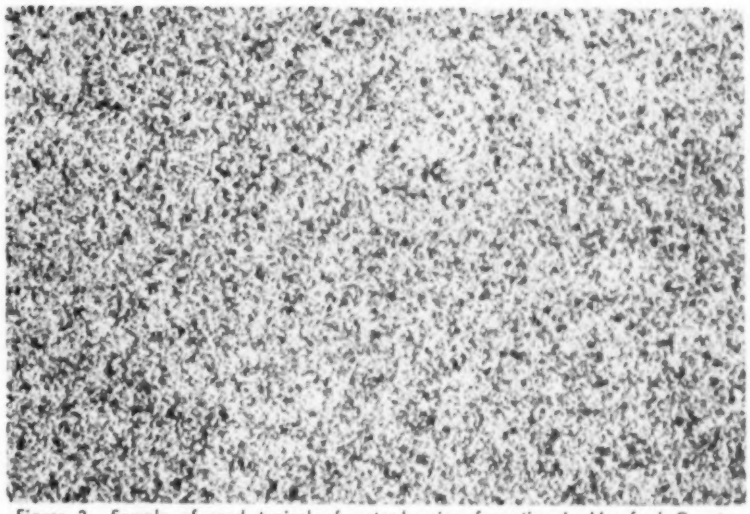

Figure 2. Sample of sand typical of water-bearing formation in Hereford County, Texas. Grains range in size from 0.006-inch to 0.025-inch.

Figure 3. Sample of coarse gravel used in gravel-packing two wells drilled in the sand formation shown in Figure 2. Note the size of voids in this gravel compared to the size of the sand grains.

Figure. 4. Sample of finer gravel used in gravel-packing a third well in the formation of Figure 2. This material is better than the coarse gravel shown in Figure 3 but is still too coarse to properly control the formation sand. The voids in this gravel average 0.035-inch in size.

Gravel-packed, slotted-pipe, irrigation well. Discharge pipe is elevated to allow sand to pile up.

REASONS WHY SOME WELLS ARE DISAPPOINTMENTS

(Continued from Page 3)

After selecting the gravel-pack material, the next step was to select the correct size of slot openings of the Johnson Well Screen to be used. The slot size required to retain and control the gravel-pack was 0.040-inch or No. 40 slot.

Note here the logical steps that must be followed in designing a gravel-packed well: first, analyzing the formation sand; second, determining the grading of gravel in correct relationship to the grading of sand; third, selecting the correct size of screen openings based upon the grading of the gravel. (Thickness of the gravel envelope, screen diameter and screen length are other essential elements of the complete design but are not so directly related to the problem of sand-pumping.)

The driller ordered the well screen for the job and drilled the fifth well on the ranch. He had difficulty in getting the recommended material for the gravel-pack, and so accepted a little coarser material from the gravel producer, thinking that it would work satisfactorily. The material he obtained is shown in actual size in Figure 4. This material is in the size range of $\frac{1}{8}$-inch to 5/16-inch. Although much finer than the gravel in Figure 3, it is still not the correct size for the formation sand in question. Experience proved this when the fifth well was completed, for it, too, pumped some sand. While the quantity of sand pumped was far less than that from any of the other four wells, the fact remains that the results were not as good as they would have been if the correct grading of gravel had been used. The well would have been sand-free had the recommendations been carefully followed.

The conclusion to be drawn from this experience is the necessity of following the three direct, logical steps in gravel-pack design. We repeat them here to emphasize their importance:

1. Determine the grading of the sand of the water-bearing formation.
2. Select the gravel in the proper size and grading to control the formation sand.
3. Choose the screen slot-openings to retain and control the gravel.

Installing 12-inch Johnson Well Screen, 28-feet long, in irrigation well near Shallowater, Texas. Well is 172-feet deep; measured yield, 800 gpm at 32-feet drawdown. Drilling contractor, Fred Kelly of Lubbock. Bottom 13-foot stratum, natural-development; upper 15-foot stratum, artificially gravel-packed.

Where gravel-pack construction may be demanded or required, we are glad to work with the well drilling contractor in working out the correct design based on the principles we have developed.

Canning-Plant Wells in Michigan

Another interesting situation where gravel-packed wells gave disappointing results because of sand-pumping was solved satisfactorily by replacing them with naturally-developed wells. This experience occurred at a canning plant in Michigan.

The first well for this plant was drilled a little over ten years ago. War-time restrictions at the time made it necessary to use a galvanized Armco Iron well screen, rather than brass or bronze. The water-bearing sand was analyzed and the screen was made with No. 14 slot openings. The well was naturally-developed and tested at about 300 gpm.

Some six years later the well decreased in capacity somewhat, due to light incrustation. Acid treatment could not be used effectively to clean the well because it was feared that the acid would ruin the screen. This situation, plus the fact that the water needs of the canning plant gradually increased, made it necessary to add a second well to the system two years ago.

The second well was constructed by a well driller who drills nothing

but gravel-packed wells. In this case, he put in the gravel treatment by bailing-down the well screen and following it with the gravel. When completed the well was tested at 401 gpm. This well was used during the Fall canning season and then again during the next season a year later. However, after 59 days of operation during the second season, the well pumped sand. The sand caused the loss of the last few days' production of the plant, and plugged piping and toilet facilities.

In the meantime, the first well dropped in yield so seriously that it had to be repaired. The Armco Iron screen was removed. In its place, a smaller diameter screen was used. The well was gravel-treated by bailing-down the screen and following it with graded gravel that worked down around the screen as the work proceeded. (Information on the size of gravel used is not available.)

After 30 days of operation, this well suddenly pumped a large quantity of sand—estimated at 15 cubic yards—into the water storage tank and piping. Removal of this material from underground caused the foundations of the well house and the boiler room to settle. To prevent any further damage to the buildings pumping was stopped, and the well was filled up and abandoned. Failure of the two wells left the canning plant without a water supply. Fortunately, one of them lasted until the end of the canning season so it was possible to plan for the drilling of new wells during the off-season in preparation for the 1953 run.

The owners of the plant sent samples of the water-bearing sand from the two failed wells to our laboratory for analysis. They asked for recommendations on screen slot openings for naturally-developed tubular wells and for details of design of properly gravel-packed wells. They also called in three well-drilling contractors and asked their advice. After careful consideration of all recommendations and proposals, they decided to employ the services of a well driller who assured them that the best results could be obtained from naturally-developed wells.

Locations for two new wells were selected. At both these sites, the driller found the water-bearing sand to extend 15 to 20 feet deeper than at the old locations and so was able to take advantage of a thicker aquifer. A 12-inch Everdur well screen with No. 10 slot openings was used in the first well. The yield of the well at the end of an 8-hour test was 535 gpm and the specific capacity 13.3 gpm per foot of drawdown.

A 10-inch Everdur well screen of greater length was used in the second well. The screen openings were No. 10 slot. When developed and completed, this well tested 520 gpm with a specific capacity of 13.6 gpm per foot of drawdown. Both wells are sand-free. They were used during the entire 1953 canning season.

This experience is quoted as additional evidence that gravel-packing must be done correctly to assure sand-free operation of a well. It also shows that high-capacity sand-free wells can be developed in many fine-sand formations without artificial gravel-packing if the work is done properly by an experienced driller.

An 8-inch Johnson Everdur Screen with bail-down shoe and 4" bailing line of pipe being lowered in well by Carl Laramie, drilling contractor of Kingsville, Ontario.

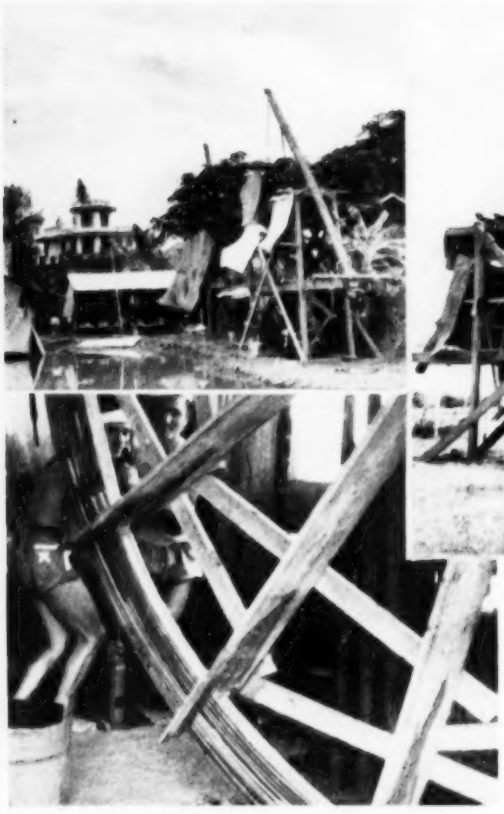

Fig. 1 (Upper Left). General view of the layout used in the ancient Chinese method of well drilling.

Fig. 2 (Upper Right). A closer view of the rig showing the upper deck for the men who furnish the power.

Fig. 3. (Below). This shows the split bamboo drilling line on the "bull-reel."

Ancient Chinese Drilling Method

The pictures on this page show the ancient Chinese method of deep-well drilling which is still used in sections of the Orient where conditions have not permitted the general spread of modern drilling methods. These pictures were sent to the Journal by Mr. E. Eisenhofer, an engineer located at Bangkok, Thailand (Siam), where the method is used to some extent for small wells.

Figure 1 is a general view of the drilling rig with the mud-pit in the left foreground. Figure 2 is a close-up of the rig showing members of the drilling crew, who act as human engines, on the upper deck. Below are the foreman and the crew helpers who guide the drill, bailer, etc.

The long "boom" or "springpole" should be noticed in particular as this furnishes the upward spring which helps lift the tools. The drilling method is a percussion method with muddy water used to plaster up the walls of the hole to keep it open, usually without any casing.

A close look at Figure 2 will show the upper connecting clamp hanging down from the boom. To this the tools are attached by means of split bamboo strips. The tools are shown leaning inside the frame of the machine and extending up above it. The large wooden wheel seen inside the frame is the "bull-reel" on which the bamboo-splits are wound. It is about 12 or 13 feet in diameter. It turns on a shaft mounted on the main deck beams.

In drilling, the iron or steel drilling tool, made in several types to fit various needs, is clamped to the boom, and it is driven down by the weight of the men and then lifted up with the aid of the spring of the wooden boom. As the well becomes deeper the split bamboo drilling line is attached to the drill tool at one end and to the boom at the other, somewhat as is done with a walking-beam type percussion drilling rig. The bamboo is a special flexible kind which is said to be grown only in China. Pieces of this bamboo about 6-inches in diameter and 12-feet long are split into four strips. These are then joined, end to end, by means of thin flat irons, until the necessary length is made. This forms the drilling line and is wound carefully onto the "bull-reel" as shown in Figure 3. This picture shows the ground drilling crew operating the bailer, as described later.

Drilling continues until it is slowed down by cuttings—usually after about a foot or two of added depth—and the drill is withdrawn by winding up the split bamboo drilling line, removing the drill, and attaching the bailer. The bailer is a metal pipe about 2 or 3 inches in diameter and 15-feet long, having a bottom valve. It is lowered to the bottom of the borehole at the end of the split-bamboo line. It is loaded with the cuttings by taking a few quick strokes; and then raised until the side opening near the top is exposed. It is unloaded by taking a series of quick strokes which wash the cuttings out through this opening.

The well is connected at all times with the mud-water pit, and

Fig. 4. Crew members furnishing the power to reel up the tools.

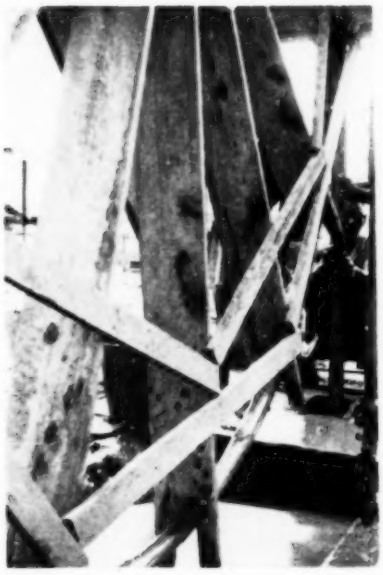

Fig. 5. Here the foreman is carefully guiding the split bamboo drilling line onto the reel.

the "slush" containing the cuttings flows into the pit where the heavier material settles out and is removed, and the drilling fluid returns to the well. Figure 4 shows the crew turning the "bull-reel" wheel by pulling and using their weight. In Figure 5 the foreman is seen carefully guiding the bamboo splits onto the reel as the tools are being raised out of the borehole. The drilling fluid can also be seen flowing to the well. No. 6 shows two of the crew guiding the bailer as it is being unloaded. Three different kinds of drilling tools are also shown at the left.

By looking carefully at this picture, Figure 6, some idea can be had of the form of the drilling tools or "bits." They do not have anything closely resembling the shape of modern jetting or solid tool drills but are more of a pointed type with prongs or knobs extending somewhat like scrapers to help in loosening the formation and bringing the borehole out to full size.

It should be noted that since the drilling line is made up of flat strips of bamboo, instead of a flexible cable, there would be no way to turn the tools beyond possibly a partial twist. The tools would have to be designed so as to avoid forming a flat hole without being rotated. From the experience of thousands of years, these people have developed the tools to fit the rest of the equipment in a remarkable way.

While it requires very specialized skill to operate a modern drilling rig successfully, it should be remembered that it also takes much skill and individual resourcefulness to drill wells with a minimum of available equipment and no source of power except human muscles.

In the last picture, Figure 7, the filter (as it is called) is being lowered into the borehole. The casing—from 2" to 4" diameter—is screwed to the top of the filter as it is lowered into place. This filter is not a screen in any sense of the word as no attempt is made to screen or develop the well but merely to supply a strainer to hold out all the sand except a little of the finest that may seep through. It is extremely crude, being made by wrapping several layers of the leaf fibers of the sisal or agave family around perforated pipe and holding them in place with ties.

While the results obtained by this drilling method are very poor in comparison with what might be obtained with modern methods and equipment properly used, the fact that fair wells are made at depths as great as 500 feet is a tribute to the ingenuity and patience of these people working under such handicaps. In most cases they must use whatever materials are at hand locally—in some cases they cannot obtain metal pipe for casing but must use hollow bamboo or wood pipes.

Fig. 6. Operating the bailer. These crew members are guiding it while others on the deck above use their weight and pulling power, aided by the spring-pole, to give it the quick up-and-down strokes which wash out the cuttings.

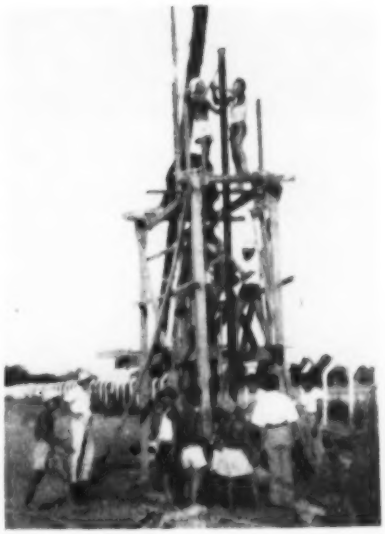

Fig. 7. The "filter" being started into the hole.

Modern methods are gradually replacing these old ones as the necessary funds and skilled workers become available. Far better results are obtained, of course, with much less labor and time being required; but it will be some time before enough skilled drilling crews can be trained to completely replace the old methods even though enough money were available. Modern methods in unskilled hands are likely to be failures; so even though this old method is crude and back-breaking, it will probably be used to some extent for years to come.

—o—

A rather reluctant conscript faced the army oculist who asked him to read a chart.

Draftee: "What chart?"

Doctor: "Just sit down in that chair and I'll show you."

Draftee: "What chair?"

Deferred because of bad eyesight, the successful evader went to a nearby movie. When the lights came on, he was horrified to discover the oculist in the next seat, but with sly, quick thinking, he asked: "Does this bus go to Chicago?"

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TOM'S COLUMN

Dear Fellows:

Well, here it is right close to th' end of another year. It won't be long before we start takin' inventory an' goin' over our books to see jest how we come out, so we kin settle things up with our "s i l e n t partner," Uncle Sam. There's been lots o' times when I'd like to trade places with him—let him be th' active partner an' me th' silent one. It would be fun fer a change to have somebody else take all th' headaches an' worries an' jest sit back an' have nothing much to do, but a little criticizin' now an' then. An' when th' year was over it would feel good to get my share all in cold cash an' let my partner take a good part of his in equipment an' book accounts an' supplies an' other things you can't eat or buy th' wife a Christmas present with. I reckon that same idea has gone through your head, too, when th' time comes to figure out your taxes.

Oh well, we wouldn't trade places with other parts of th' world—and one big reason we wouldn't is because we can still let off steam by belly-aching to our hearts' content an' not land in th' jailhouse. Us folks in th' free world have got th' best Christmas present of all—personal liberty—an' by blazes, we'd better keep our eyes open an' see to it that we don't lose it to any rascals inside or outside of our own borders.

I watch th' kids as they sprout wings being so good before Christmas. I look at the purty decorations ev'rywhere—the nice music comin' over th' air—an' a sort of general feeling of good nature that seems to take over even some of th' best full-time grouches I know. Sure, there's a lot o' tinsel an' nonsense about it; but there's a darned sight more good. I wouldn't cut Christmas out o' my calendar fer all th' tea in China—an' I know doggone well you wouldn't either. So all together boys—"Merry Christmas—even to th' tax collector!"

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J. E. Miller, President.....LaVergne
E. S. Eatherly, Secy-Treas.....Lebanon

Texas

L. W. Capps, President.....Houston
F. L. Protzman, Secretary.....Houston

Virginia

Justin Ange, President.....Fairfax
C. R. Sundquist, Secy.-Treas.....Norfolk

Washington

Harold O. Meyer, President.....Kirkland
George L. Zent, Sec'y-Treas.....Vancouver

Wisconsin

Elmer Sperling, President.....Iron Ridge
Ralph H. Nienow, Sec'y-Counsel.....Merrill

Gettin' onto th' subject o' well drillin', we finished up a little job here a couple or three weeks ago that was kind of interestin', an' I thought I might pass it along to you.

It was a well fer a house out on a nice farm not far from town. They had an old well drilled in an offset of th' basement which was so blamed small you couldn't hardly shift your cud o' tobacco when you got in there to work. Why in thunder architects an' house-builders will do things like that, I don't know. Here was a house that cost 'round $5,000 when they put it up —an' would cost $25,000 today— an' they saved maybe a measly ten bucks by makin' that well-offset so danged small it was too crowded for a shadow to move in it. An' then they expect a 200-pound well driller to work in there.

Well, by standin' on one leg an' grunting in three languages we managed to clear things out an' get down into th' well. It was a 3-inch 207-foot deep well finished with a 2-inch 60 gauze flush well point. Th' well was put in first in 1933 an' th' point was changed last time in 1950. When it was first finished, it must of been a good well because th' driller who put it in only set th' 2½ x 16 flush cap cylinder down about 40 foot which was only 5 foot below where th' record showed th' water level stood.

Oh yes, there was somethin' mighty unusual 'bout this well— they had good records on it. You remember me mentioning Sam, my ol'-time competitor? Well, this is one of th' wells he drilled right under my nose. An' Sam always left a good record of his wells with the owner. Usually the owners manage to lose these records; but this time it was all there from start to finish.

Gradually th' well must of fell off because they made deeper pump settings, an' when they had put in a jet pump back in 1950, they lowered it down to 100 foot. Th' static water level had only dropped from 35 foot to 42 foot in them years. Th' well had been short on water an' had started pumpin' cloudy toward th' end. We suspected what was wrong, o' course, an' when we run down inside we found th' well point half full o' dirty, fine sand. Th' casin' had rotted out at about 50 foot where there was a vein o' water in fine, clayey sand, an' this stuff had started coming in. Well, we knew it would be a waste o' time an' money to monkey with this hole; so all we could do was try

(Continued on Page 16)

LETTERS TO SANTA--

Busy little rascals, going 'round like angels just before Christmas. I've got a sneakin' hunch they know them letters will end up in grandpa's mailbox. But what a lot o' fun it is, anyway! Makes all th' work an' sweat of th' months before seem more worth while.

So here's *my* letter to Santa:
"Keep coming, ol' boy. Us old folks need you just as much as th' kids."

TOM

(Continued from Page 9)

to shove in another well as close as we could to this one. It was bad working in such close quarters an' if th' condition of th' old well had been a little better, we would of tried pullin' it an goin' down in the same spot. Anyway, we figured we could get a new 4-inch right up close to it an' not be any worse off fer room than we were at th' start. (We don't drill smaller than 4-inch any more except fer some special reason like deepening a job or if we have to reduce near th' finish of a deep farm or house job. Actually our costs fer a 3-inch well showed up higher than fer a 4-inch. Have you had th' same experience?)

Nothing happened out of th' ordinary when we ran th' new hole down. We had a log to follow an' knew jest what to expect; so it was duck soup. Th' driller stopped when he got down to the same depth as th' bottom of th' well point in th' old well. He brought in his sand samples an' drillin' log and went home. We do a good bit o' this kind of drillin'—farm an' suburban house wells finished in sand formations—so we keep a stock o' Johnson Well Screens on hand with th' usual range o' slot sizes we need. My son has rigged up a set o' screens, scales, etc., an' he runs off these ordinary run-of-th'-mill jobs an' picks out th' right screen from our stock an' then orders a replacement screen. That way we only send samples to th' Johnson factory on th' jobs where things look out of th' ordinary or on bigger jobs.

Anyhow, fer this job th' boy picked out a 4-inch 5-foot No. 30 slot Everdur screen. Th' driller got it th' next mornin' on his way 'out to th' job an' by noon he was back tellin' us he had a lousy well on his hands. Said it cleared up right now, didn't develop worth a hoot, an' th' water level dropped down considerable just with fast bailing.

"Did you notice anything when you went through th' vein?" I asks him.

"Well, it didn't have any life to it," he says. "Didn't come good with th' bailer an' I did some drillin' on th' plugs."

"Uh-huh! Then you got your samples?"

"Yep!"

"O.K. Let her go fer today an' we'll give it a go tomorrow. You an' Jim go out an' stick in that pump at the motel," I says.

It was purty plain what was wrong, as you have probably guessed already. That night I talked 'bout it with my son an' he said he noticed th' samples looked kind o' funny. Leastwise we agreed on what to do an' we done it th' next day. That's right—we acid-treated it. And good, too! We knew we'd have to reach back purty well if we were right in our guess.

When we finished th' treatment an' put in th' surge we got good results. Th' job developed like it should—in fact a little more so because th' screen slot was a little on th' big side; but it came through, in good shape. We put back th' jet pump an' held it up off the well so we could check th' drawdown. We let her pump as steady as we could keep it at 10 g.p.m. an' th' water level only dropped between 2 an' 3 foot on a 2-hour test. So we chalked it up as a good well an' finished th' job.

Well being drilled for canning plant near Springville, Utah, by Thomas Woodhouse of Payson. Artesian flow here is about 120 gpm from 200-depth. Casing was then driven deeper to shut off flow.

With the flow shut off, the job was left overnight. The artesian pressure and leakage around the casing made a "quicksand" condition resulting in this catastrophe that Mr. Woodhouse found the next morning.

Yessir, there ain't any question but th' whole area right around that old well was purty well cemented off, an' it reached out so it had cut off a good part of th' flow into the new well. There was enough of this 'round th' new well screen so it cleared up in a hurry an' didn't do any developing to speak of.

An' that's that! Never had one like it before an' don't reckon I'll ever have another. But it's all a part of th' well drillin' business—you've got to learn a lot o' things—big an' little—by jest running up against them. You don't find it in th' books. What th' old Dutchman said sure fits this business—"Too soon ve get oldt, too late ve get schmart!"

Yer ol' friend,

TOM

E. E. Hoaglund of Minneapolis, drilling 6-inch well for filling station.

RUNNING WATER

Running Water brings us health
And other things worth more than wealth.
Without it we would thirst and smell,
Our homes might burn or wouldn't sell.

It irrigates sweet peas and roses,
Washes necks and ears and noses;
At the movies cools the air
For the lovesick, spooning pair.

Running Water puts out fires,
Sprinkles the lawn and never tires;
Bathes the babe, his pants and gown;
Makes insurance rates go down.

Flushes toilets, fills the tub
For dirty clothes, aye, there's the rub;
Wets our whistles, keeps us clean,
Makes the vegetables green.

These bounties Running Water brings
Alike to common men and kings;
And so from birth clear to the end
Running Water is man's best friend.

Courtesy Ford Meter Box Co.
Wabash, Indiana

LEGAL STATUS OF GROUND WATER

Interest in legal control of groundwater use and well drilling increases constantly. Many states are adopting new laws or new regulations. All drillers need to be informed on what is taking place.

Nevada

Changes in the groundwater laws of Nevada by the 1953 legislature allow the state engineer to apply the state regulations for conservation and appropriation of groundwater in any area where he finds, thru investigation, that such control is needed. Previously, the state engineer could do this only on petition of 15 per cent of the well owners in a basin or groundwater area.

Procedures for forming water and sanitation districts in certain counties have been set up. Another law requires persons planning rainmaking experiments to notify the state engineer of their intentions.

The legislature appropriated some $16,000 for state groundwater studies and over $22,000 for co-operative ground-water investigations.

Wisconsin

The new Code Manual of well construction and pump installation has been compiled by the Board of Health. It consists of some 40 pages which interpret and enlarge on the previously printed Code. It contains many diagrams and drawings showing almost every conceivable type of pump installation.

All offset pump installations, whether for shallow-well suction-lift or deep-well jet pumps, that serve more than three families or the public must have the horizontal piping contained in "pressurized conduit."

Well drillers who do pump installation after January 1 must register as "pump-installers" by December 31, in order to comply with a law passed by the Wisconsin legislature. The fee is $10, which is in addition to the regular fee for registration as a well driller. Pump-installers must observe code regulations on the sanitary character of each installation.

Alabama

The legislative committee has recommended to the state legislature the establishment of a new law as a first step toward allocation of the ground water of the state for beneficial use.

The proposed law would require an owner to obtain a well permit from the Alabama Geological Survey before drilling a new well (or making a major improvement to an old one.) The permit would include regulations under which the well may be constructed. Permits may not be refused for domestic and stock wells.

Waste of water from flowing wells of all kinds is prohibited. Plugging of abandoned wells or test holes is required.

Well drillers would be required to report well logs and details of construction of all wells completed. This information, together with that given on the applications for well permits, is intended to provide some of the essential groundwater facts needed to allocate intelligently the ground-water resources of Alabama.

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The power of the state is measured by the power that men surrender to it.

—Andrew Carnegie.

Setting 15 feet of 10-inch Johnson Well Screen in irrigation well. Completed well pumped 325 gpm. Drilled by E. C. Finch and Son, Galesville, Wisconsin.

ASSOCIATION NEWS

This section is devoted to the exclusive use of water well drillers' associations, both state and local. Notices, announcements, changes of officers and other items should be sent to The Editor, Johnson National Drillers' Journal, 2304 Long Ave., St. Paul 14, Minnesota.

VIRGINIA

The annual meeting of the Virginia Water Well Drillers Association was held in Richmond on October 13. In addition to the election of three directors to serve for the next three years, a general discussion concerning the activities of the association was held.

Several committees were appointed to carry on the projects outlined. The projects have to do with insurance in various forms, as it pertains to well drilling, and closer co-operation with the State Board of Health regarding sanitation and testing of water supplies.

The convention tentatively selected the dates of May 7 and 8, 1954, for the next annual meeting. This would be held in Winchester, if present plans are carried through. If there is any change of date or place, the new information will be carried in this column.

The following officers were elected for 1953-54:

Justin Ange, President, Fairfax.

D. C. Magette, 1st Vice-President

Paul Schweitzer, 2nd Vice-President

C. R. Sundquist, Secy - Treas., Norfolk.

Ben A. Chappel and W. C. Falwell were elected directors.

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MISSISSIPPI

The annual meeting of the association was held at Batesville, Mississippi, on September 11. Besides the active members, there were a number of limited and associate members present, as well as quite a few wives.

The regular meeting was held Friday afternoon, with Cliff Switzer presiding over the meeting. A barbecue was served in the evening to all members and their families, courtesy of an associate member. Two moving pictures describing well drilling and pumps were shown later in the evening, and all members agreed that they were well worth seeing.

The executive meeting was then held, and the following officers were elected for the coming year: Fred Sutter, President, Pass Christian; James Lipe, Vice-President, Pope; Joe Miller, Secretary-Treasurer, Lyman.

Directors elected were: N. W., Claude Bailey, Lexington, and James Lipe, Pope; N. E., Robert Ashby, Van Vleet, and J. C. Reeves, Amory; S. W., Bill Bidwell, Columbia, and Fred Sutter, Pass Christian; S. E., James Porter, Laurel, and H. J. Morey, Laurel; Director at Large, E. W. Hall, Jackson.

Connecticut Well Drillers Association set up and manned this exhibit at the Eastern States Exposition held September 20 - 27. The display included geological maps and sections, rock samples, pumps, well-drilling tools, and well screens. Members of the Association got many valuable customer-inquiries and found that the exhibit was a very worth-while undertaking.

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NORTH DAKOTA

The 38th annual meeting of the North Dakota Association was scheduled for December 7 and 8, in the War Memorial Building at Bismarck. This convention was held too late to be reported in this issue of the Journal; so details will appear in the next issue.

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WASHINGTON

November 13 and 14 were the dates of the annual convention of the Washington Association, at the New Washington Hotel in Seattle. There were discussions of drilling problems encountered by members, sanitation, insurance, oil well drilling, and pipe manufacture. Cocktail parties and the annual banquet and grand ball provided plenty of entertainment for everybody, including the many wives that attended. There was a special program set up for the ladies, which made the meeting even more enjoyable for them than it has been in the past.

Reports on the election of officers and directors will follow at a later date.

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PENNSYLVANIA (Eastern Section)

The regular sectional meeting of the Eastern Section of the Pennsylvania Well Contractors' Association was held at the Hotel Brunswick, Lancaster. Luncheon was served to 50 members and guests on August 22.

Ray Gordon, export manager of the Bucyrus-Erie Company, gave a talk, illustrated with color slides, on his experiences in South America.

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OKLAHOMA

The 5th annual convention of the Oklahoma Association will be held on Friday and Saturday, De-

cember 11 and 12, at the Extension Center, North Campus, University of Oklahoma, at Norman.

The topics to be discussed include the licensing law, ground water formations and yields, gamma-ray and neutron surveys, sand identification, and the new Oklahoma City well-field development.

Wives are invited this year; so plan on coming, one and all. A good time for everybody is guaranteed, and you're sure to learn something.

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SOUTHERN CALIFORNIA

The Water Well Drillers Association of Southern California held its annual convention on October 2, at the Rodger Young Auditorium in Los Angeles. The members and their guests arrived in time for the scheduled noon luncheon. Following the afternoon business meeting an interesting program was presented which included addresses by Harvey A. Mylander, well hydrologist, James E. Wright, association president, and a representative of the Byron Jackson Company. An evening banquet was followed by entertainment and a dance. It was a well-attended and successful convention.

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KANSAS

The Kansas Association held its annual meeting in Emporia, Kansas, on November 6 and 7. The program included papers and general discussions on a number of subjects such as laws and regulations, irrigation wells, safety codes and pollution problems.

In the business meeting, the following officers were elected: Hazen Bledsoe, president, Strong City; Lon Dietrich, vice-president, Ottawa; W. L. Hendee, Sr. secretary-treasurer, Muncie; A. O. Caylor, director northeast district, Manhattan; J. M. Jewett, service-secretary, Lawrence.

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COLORADO

The Colorado Association held its twentieth annual convention in Denver on November 13 and 14. A total attendance of about 150 was tabulated. Two members of the Bureau of Reclamation presented talks—Dart Wantland on the subject of geophysical "water-witching," and W. M. Tapp on well screens and well development. George McGrew of Stardrill-Keystone Company gave operating information on his company's combination drilling rig. Ivan Crawford of the State Conservation Board spoke on the ground water law and its effect on the well driller.

Luncheons, a Friday-night stag dinner, and the annual banquet on Saturday night provided the necessary entertainment and diversion from business matters.

Officers elected for the coming year were: N. W. Schoene, president, Golden; F. C. Eddy, vice-president, Moffatt; Floyd Oliver, Jr., secretary, Greeley; George C. Koogle, treasurer, Denver.

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NORTH CAROLINA

A re-organization meeting of the North Carolina Well Drillers Association was held at the Robert E. Lee Hotel, Winston-Salem, on September 19. At that time it was decided by the Board of Directors to re-activate the dormant association. Officers elected at this meeting were: P. Y. Bainbridge, president, Guilford; Jack Faw, vice-president, Hickory; R. O. Heater, secretary, Raleigh.

The first annual meeting of the new association was set to begin at 12:30 p. m. with a luncheon at the Lee Hotel on Saturday, November 21.

ILLINOIS

There has been a change in the plans for the Illinois convention which should be noted by all members. The convention will be held on January 20, 21 and 22, 1954, as previously announced; but at Joilet instead of at Urbana.

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N.W.W.A. CONVENTION

The National Water Well Association held its annual convention in Philadelphia on October 27 to 30. The eastern and western divisions of the Pennsylvania Water Well Contractors Association acted as hosts. There was a good attendance reported. Many interesting displays and a program of varied subjects were presented for those who attended. Cocktails and a banquet were given by the host associations on "Pennsylvania night."

T. W. Thorpe, of Des Moines, Iowa, assumes the office of President for 1953-54. Robert R. Storm continues as Executive Secretary.

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People think of the Golden Rule as something mild and innocuous, like a baby lamb. But when they suffer an infringement of it, they think they've been mauled by a panther.

—Francis Wren.

Test pumping an irrigation well in Oklahoma. Well is equipped with Johnson Well Screen. Driller is Joel Yarborough of Enid, Oklahoma.

ASSOCIATION NEWS

(Continued from Page 13)

NEBRASKA

The Nebraska Well Drillers Association will hold its twenty-third annual Short Course and Conference on Thursday and Friday, February 18 and 19, 1954. The meetings will be held in Bancroft School Building on the downtown campus of the University of Nebraska in Lincoln. All Nebraska drillers are reminded to keep these dates open.

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ILLINOIS

Notice was received just before going to press that the Illinois Well Drillers Association will hold its convention on January 20, 21, and 22, in the Woodruff Hotel, at Joliet, Illinois. The opening session will be at noon, Wednesday, January 20, and the get-acquainted party will be held on that evening. Technical sessions, business session and the annual banquet will be on Thursday, with final meetings on Friday morning.

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Years of observation have brought us to the conclusion that the only reason a great many American families don't own an elephant is that no one has ever offered elephants for a dollar down and easy monthly payments.

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The reporter came strolling idly into the office.

"Well," said the editor, "what did our eminent statesman have to say today?"

"Nothing."

"Well, keep it down to one column."

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Two English cockney broom vendors met on a London street and started to talk business at once.

"'Ang it all," said one, "I don't see 'ow you can sell these 'ere bloomin' brooms for a shillin'. I steals the brush, an' I steals the wire, an' I steals the 'andles an' I can't sell 'em for a shillin' an' make any money on 'em."

And the other replied: "Why, I steals them ready made."

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Farmers in the Middle West report that last summer's drouth was so bad that the sparrows had to get down on their knees to reach the oats.

ADVERTISEMENTS

We will insert advertisements for drilling equipment wanted or for sale, help or work wanted, etc., for our readers, free of charge. Advertisements must be brief, and we cannot assume responsibility for them, but will be glad to put parties in touch with each other by this means and suggest that they investigate any offers or inquiries carefully for themselves.

FOR SALE: One medium-weight rotary, water-well rig mounted on Ford truck; 40' mast, 4 cross-block sheaves in top, raises and lowers with power unit, lays down over cab of truck; 4½" x 6" Gardner-Denver mud pump; friction-type hoist with enough ⅝" cable to string seven lines; two 60 h.p. LeRoi power units, both equipped with twin-disc clutch and heavy transmission with chains; rotary table by American Iron Works, adjustable opening from 2" to 10½" with chain feed; fully equipped with tools for 2" to 8" wells. In A-1 condition, ready to go. Four good swivels, good hose, mud mixer. Price $5500.00 for all. Huey A. Woodward, Route 5, Franklinton, Louisiana.

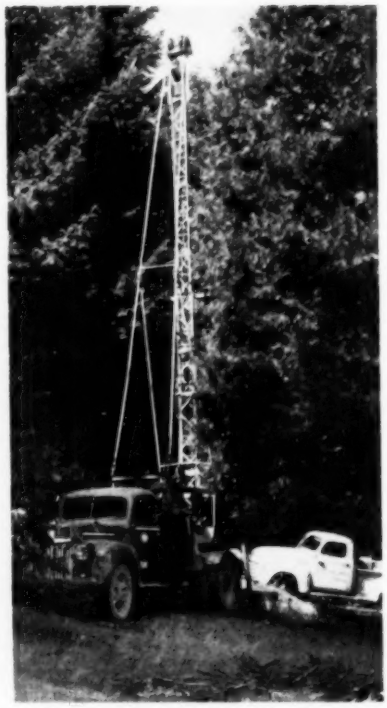
FOR SALE: Failing 1500-S also Failing 1000 rotary. Can supply other rotaries; good used equipment. Want Keystone, Star or Bucyrus used equipment. Fred E. Butler, Box 481, Pueblo, Colorado.

FOR SALE: Nine new drilling rigs. 3 Bucyrus-Erie Model 24-L drills, combination 10-13A. 3 Winter-Weiss reverse circulation Portadrills; designed for water-well works. 3 Howard-Turner "Drillmaster" portable rotary drills, each with Gardner-Denver FYFXX slush pump units mounted on separate 4-wheel trailer; capacity 2500 ft. 3½" drill pipe. All 9 rigs are trailer-mounted and diesel-powered. Immediate delivery, subject to prior sale. Write, Box RMP, c/o Edward E. Johnson, Inc., 2304 Long Avenue, St. Paul 14, Minn.

FOR SALE: Sullivan No. 37 drill mounted on 1941 Ford 1½-ton truck, Gardner-Denver 4x5 duplex mud pump, completely equipped, ready to drill. Drill completely overhauled. Truck has new exchange motor. For quick sale $3500.00 cash, f.o.b. my shop. J. L. Havlick, 2703 No. Pittsburg Street, Spokane, Washington.

FOR SALE: 1950 cable tool drilling machine, mounted on good 1947 G.M.C. truck; all steel rig in near-perfect shape. Built from over 50 years drilling experience; has catheads for rope work; good power unit. Comparable in size to 22-W. Mr. R. E. Rasmussen, 497 Elmwood Drive, Council Bluffs, Iowa.

FOR SALE: Complete drilling and pump business. Warehouse, drilling machine, trucks, and all necessary tools to drill wells from 5" to 12". Attractive price; will give terms. Must sell because of poor health. Doing nice business, and have contracts ahead. Good location. F. E. Mead Well Drilling Company, 1214 11th Avenue, North, St. Cloud, Minnesota. Phone 3093.



Casey Jones of Creswell, Oregon, drilling 5-inch well on a lovely suburban homesite at Oakridge, Oregon.

FOR SALE: New 22 H.P. LeRoi power unit with impulse starting magneto, governor, twin-disc clutch, enclosure. Never used. Price, $275.00. Drilling line, 700 ft., ¾", lang lay, used once, A-1 condition; price $180.00. Drilling line, 1250 ft., ¾" lang lay, drilled only 1000'; price $250.00. Ralph Scott, R.R. 3, Pendleton, Indiana; phone 294-R.

FOR SALE: No. 71 Speed Star drill mounted on 1945 International Truck; machine and truck in very good condition. No tools. John Hamilton, Ellsworth, Wisconsin.

FOR SALE: Florida well drilling and pump business. Plenty of work. Complete line of machinery and tools. Located in Florida's largest west coast city. Three-bedroom house adjoining can be had. Write Box BL, c/o Edward E. Johnson, Inc., 2304 Long Avenue, St. Paul 14, Minn.

FOR SALE: 1948 Model 21-W drill with catheads, good condition, mounted on International 1½ ton truck; complete with 325' of ⅝" drill line and ⅜" sand line. Will accept any reasonable offer. Holbeck Well Works, Devils Lake, North Dakota.

WANTED: One good used drilling jar for 5" work with a 1⅝"x2⅝"-7 API joint, 2¾" wrench square. J. M. Suheski, Crystal Falls, Michigan.

WANTED: Bucyrus-Erie 20W or 21W; or late model Ideco drill. Must be truck-mounted. Please give model of truck, condition of equipment and price in reply. O. E. Lewis, Darlington, Indiana.

FOR SALE: No. 16 Ideco drilling machine in good condition. Mounted on a good truck and priced to sell. Write or call Eldon Bonnicksen, Estherville, Iowa.

FOR SALE: New 5⅝" casing; new 6" pipe; used pipe and casing. Write for new price list. Thomas H. Scheuren, 933 Fern Avenue, Reading, Pennsylvania. Telephone 41287.

FOR SALE: All steel Howell #60 rig with Bucyrus-Erie derrick and shock absorber; mounted on 1942 Chevrolet, good tires and motor. Price $1200. Spitzer Well Company, Marshall, or Tracy, Minnesota.

FOR SALE: Going out of business. Armstrong band-wheel drilling machine, semi-truck mounted; 4 cylinder I.H.C. power plant. Tools include: 3 bars, 4 x 18, 3½ x 12, and 3½ x 18; one 2½ x 27 string of tools, new; two sets of 4-inch jars; slip socket; 10", 8", 7", and 6" bits; bumper bar. Will sell all or part. See at Iowa Falls, Iowa, 609 Dale Dr.; or write Glen W. Smith, 1341 E. Villa Street, Pasadena 4, California.

WANTED: Need experienced, sober, well driller, age 30 to 60; good wages, steady work. Stewart Bros., P. O. Box 976, Schenectady, New York. Phone 6-2029.

FOR SALE: One No. 55 Speed Star drill with 33-foot telescoping derrick (in operation every day); mounted on 1½-ton, 1936 Chevrolet truck. Some tools. Mostly 2" and 3" wells. Ford pickup, 1945 model. Also 6-room house and 6 lots in fast-developing area on west coast of Florida. All for $9500. Reason for selling, other business. J. W. Cooper, P. O. Box 101, Freeport, Florida.

WANTED: Irrigation well drilling machine or component parts; also test-hole drill of smaller type. Ulysses Electric Implement, Ulysses, Nebraska.

FOR SALE: One Fort Worth spudder and tools, Model L, with International truck. P. O. Box 342, Prosser, Washington.

FOR SALE: No. 60 Keystone and No. 50 Keystone drills, with or without tools. Will sell mounted or unmounted. Box PT, c/o Edward E. Johnson, Inc., 2304 Long Avenue, St. Paul 14, Minnesota.

WANTED TO BUY: Either Keystone Model 26-K or Bucyrus-Erie 24-W drills. Must have casing reel and calf wheel. Give full particulars as to condition and best price. John Herbertson, c/o Box 728, Anchorage, Alaska.

WANTED: Drillers for all types of wells. T. W. Van Winkle and Son, Salem, Iowa.

WANTED TO BUY: Model 24-L drilling machine. Give condition, equipment, and price first letter. T. W. Van Winkle & Son, Salem, Iowa.

WANTED TO BUY: If priced reasonable, would like to buy medium or large sized water well drill; must be late model in good shape. Bob Tatro, Route 1, Box 96-A, Okmulgee, Oklahoma. Phone 9510FZ.

WANTED: Would like to go to South America as a water well driller for a couple of years; or would accept job with a large pump manufacturer as salesman for Texas territory; experienced and good reputation. J. W. Ball, Box 872, Grapevine, Texas, telephone 384-W.

FOR SALE: Model L Fort Worth Spudder with tools, mounted on 1942 International truck; Model B International drilling motor; all in good condition, $2000.00. J. W. Ball, Box 872, Grapevine, Texas, telephone 384-W.

FOR SALE: Model 24-W Bucyrus-Erie drilling machine, 1945 model; V-belt drive. Semi-mounted on 7.50 duals, leaf springs with vacuum brakes, $5200.00. Also available: drilling tools, 2-ton, cab-over, 1950 Chevrolet truck; 1100' of ¾" drill line and ⅝" sand line; water tank; chain tongs and numerous hand tools; 200-amp welding machine built into rig. A & B Drilling Company, Box 182, Scobey, Montana.

FOR SALE: Bucyrus Erie 21W with LeRoi motor, mounted on 1934 Ford; motor and tires in good shape; all in working order. Has 500' of ⅝" drill line and 300' of ⅜" sand line. Price $1500. Douglas Holzem, 1975 Prairie Avenue, Beloit, Wisconsin.

FOR SALE: No. 26 Cyclone drilling machine with IXB Hercules power unit, mounted on International truck with 9.00 dual tires. Price $1200, including drilling cable and sand line. George E. Martin & Son, 3103 Martindale Road, Canton 4, Ohio.

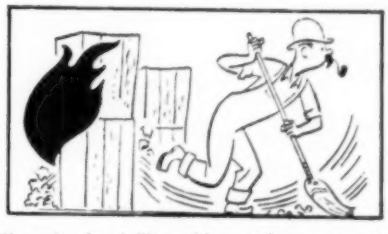
FOR SALE BY OWNER: One 6 stage Smithway water lubricated deep well turbine, complete with right angle gear drive for 500 g.p.m. 225' total head, 1,760 r.p.m. 70 feet 6" x 1¼" column, 20' suction pipe, prelubricating tank and fittings; pump brand new, never uncrated; price $1,850.00, immediate delivery. Write or wire, Box ABC, 2304 Long Avenue, St. Paul 14, Minnesota.

FOR SALE: Two new Deming 6" stroke deep-well heads, ½ and ¾ H.P. One new Crane deep-well head ¾ H.P. Two used Crane 6" stroke deep-well heads, ½ and ¾ H.P.; one used ¾ H.P. Myers head. All overhauled and guaranteed good as new. One used 1½ H.P. #287 2-stage Berkeley jet pump, single phase motor, overhauled and like new; reasonable. Ray L. Lacey, 4919 London Road, Duluth, Minnesota.

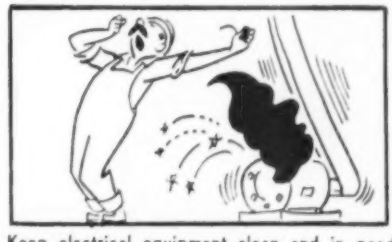
FOR SALE: 1000 ft. 5" new standard pipe with line pipe couplings, $1.40 per ft. Ray L. Lacey, 4919 London Road, Duluth, Minnesota.

Don't Let FIRE Fire You

Fire can fire you and your whole crew. Fire insurance may cover your loss of property and equipment; but insurance won't keep the business going or pay for the work you lose while you rebuild your shop. About 90 per cent of industrial fires can be prevented by rigidly following a few sensible rules. Some of these common-sense rules are given below. Insist that everybody follow them in your shop, so that fire won't fire you or the men who depend on you for their jobs.



Keep it clean! Fire seldom strikes a properly maintained shop. Don't let shavings, waste, and other debris pile up in corners.



Keep electrical equipment clean and in good repair. Replace frayed extension cords. Be careful not to overload electrical circuits.

Keep flammable liquids in safety cans and at a safe distance from sparks and flames. Put all oily rags in tight metal containers.

Check heating devices regularly. Keep all combustibles away from furnaces and other heat sources, such as space heaters and welders.

Well, another Christmas has rolled around again. The nicest thing about the whole year is the warm feeling that touches all of us at this season. You can't help but believe in Santa Claus, right along with your children and grandchildren, for he's the spirit of Christmas—kindness, happiness and good fellowship. His is the genuine spirit of "peace on earth and good-will toward all." From all of us at Johnson's, to all of our good friends who make our business success possible, a really

Merry Christmas and Happy New Year

EDWARD E. JOHNSON, Inc.